IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application of: JOSEPH B. KEJHA et al. Examiner: Best, Zachary P.
Serial No. 10/516,986 Art Unit: 1795
Filed: 12/06/2004

Title: **LITHIUM BASED ELECTROCHEMICAL DEVICES HAVING A CERAMIC SEPARATOR GLUED THEREIN BY AN ION CONDUCTIVE ADHESIVE**

BRIEF OF APPELLANTS

This is an appeal from the final rejection of the Examiner dated September 16, 2008, rejecting claims 2, 4-10, 12-17 and 20-14 being all the rejected claims in the case. This brief is accompanied by the requisite fee set forth in Sec. 1.17(f).

REAL PARTIES IN INTEREST

The real parties in interest are Joseph B. Kejha, W. Novis Smith, Joel R. McCloskey, and Lithchem International.

RELATED APPEALS AND INTERFERENCES

There are no related appeals and interferences.

STATUS OF ALL CLAIMS

This application was filed on December 6, 2004. Claims 1-9 of this application were rejected on February 27, 2008. An amendment was filed on May 24, 2008 Claims 2, 4-10, 12-17 and 21-24 were finally rejected on September 16, 2008.

The status of the claims is as follows:

Allowed claims: None

Cancelled claims: 1,3 5-8, and 19-20.

Claims objected to: 20

Claims rejected: 2, 4-10, 12-17 and 21-24

Claims 2, 4, 9-10, 12-17, 21 and 23 were rejected under 35 U.S.C. Sec. 103(a) as being unpatentable over Aihara et al. No. US 6,387,565 B1 and in view of the US Patent to Hikmet No. US 6,558,840 B1, Gozdz et al. No. US 5,554,459 A1 and Shibuya et al. No. US 6,291,098 B1.

Claim 22 was rejected under 35 U.S.C. Sec. 102(a) as being unpatenable over the U.S. Patent to Aihara et al. No. US 6,387,565 B1., n view of the US Patent to Hikmet No. US 6,588,840 B1, Gozdz et al. No. US 5,554,459 and Shibuya et al. No. US 6,291,098 B1.

Claims 5-7 and 24 were rejected under 35 U.S.C.103(a) as unpatenable over Aihara et al. in view of Hikmet, Gozdz et al., and Shibuya et al.

Claim 8 was rejected under 35 U.S.C. Sec. 103(a) as unpatentable over Aihara et al. in view of Hikmet, Gozdz et al., and Shibuya et al. as applied to claims 2, 4, 9-10, 12-17, 21 and 23 and in further view of Coustier et al. (US 2002/0110732A1).

Appellants appeal the final rejection of claims 2, 4, 9-10, 12-17, and 20-14.

STATUS OF AMENDMENTS

All amendments have been entered.

SUMMARY OF CLAIMED SUBJECT MATTER

Applicant's invention is directed to Lithium based electrochemical devices which have a ceramic separator coated om a first electrode, and glued in by an ion conductive adhesive toa second electrode. They are made with a single cell, that includes a porous first electrode with a binder, which can be an anode active coated on a porous expanded metal microgrid current collector, electrically insulated particle are coated on the anode, a thin porous ceramic separator with a binder, coated on the first electrode active surface, and soliudified. A thin layer of ionically conductive organic adhesive is coated on the other side ofceramic separator. A porous second electrode with a binder is provided, which may be a cathode coated on a porous expanded metal microgrid current collector, and this second electrode is adhesively joined to the ceramic separator by the adhesive. The assembly is activated by a non-aqueous electrolyte, and is housed in a moisture proof enclosure. The electrolyte may be 1 mole of $LiPF_6$ in ethylene carbonate and dimethyl carbonate in a 1 to 1 ratio. The electrode slurries may be well known, but the polymer should be different for the binders of the electrodes and separator.

The separator binder may be polyvinylidene (PVDF) and the binders of the electrodes may be polyvinyl alcohol (PVA) or vice versa.

Claim 22 is related to the specification and drawings as follows: A Lithium based electrochemical device which comprises a first and second porous electrodes, which

electrodes each include an expanded metal microgrid with the active material including a binder coated thereon, at least one porous separator between the electrodes, which separator contains particles of an electrically insulating material and a binder, with one side in bonding contact with the first electrode active material, an organic ion-conductive adhesive layer on the other separator side in adherent contact with the second electrode and a non-aqueous electrode in contact with the electrodes and the separator, with a moisture proof enclosure surrounding the device, with sealed exiting terminals which extend from the enclosure (P6, lines 19-21, p7; lines 1-10, p8 lines 7,8).

Claim 2 dependent on claim 22 is related to the specification and drawings (p6, line 20, p7, line 7).

Claim 4 dependent on claim 22, is related to the specification and drawings (p7, lines 4-6, p9, lines 8, 11, 19).

Claim 5 dependent on claim 22, is related to the specification and drawings (p9, lines 19, 22).

Claim 6 dependent on claim 22, is related to the specification and drawings (p9, lines 19, 22).

Claim 7 dependent on claim 22, is related to the specification and drawings (P10, lines 2, 19).

Claim 8 dependent on claim 22, is related to the specification and drawings (p10, lines 3-21).

Claim 9 dependent on claim 22, is related to the specification and drawings (p10, lines 6, 13-15, 17, p11, lines 4-6).

Claim 10 dependent on claim 22, is related to the specification and drawings (p11, line 21, p12, line 7).

Claim 12 dependent on claim 22, is related to the specification and drawings (p8, lines 15-20, p9 lines 1,2).

Claim 13 dependent on claim 22, is related to the specification and drawings (p5, lines 2)

Claim 14 dependent on claim 22, is related to the specification and drawings (p4, line 2, p5, line 3, p12 line 17).

Claim 15 dependent on claim 22, is related to the specification and drawings (p5, line 3, p5, line 3, p12, line 17).

Claim 16 dependent on claim 22, is related to the specification and drawings (p5, lines 2-3, p12, line 17).

Claim 17 dependent on claim 22, is related to the specification and drawings (p7, lines 12, 13).

Claim 20 dependent on claim 22, is related to the specification and drawings (p10, lines 5-15).

Claim 21 dependent on claim 22, is related to the specification and drawings (P11, lines 1-3).

Claim 22 is related to the specification and drawings as stated above.

Claim 23 dependent on claim 22, is related to the specification and drawings (p4, lines 7-9, p9, lines 9-12).

Claim 24 dependent on claim 22, is related to the specification and drawings (p9, lines 20-23, p 10, line 1).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Was the Examiner's rejection of Claims 2, 4, 9-10, 12-17, 21 and 23 under 35 U.S.C. Sec. 103(a) as unpatentable over Aihara (US 6,387,505 B1) in view of Hikmet (US 6,558,840 B1) Gozdz et al. (US 5,554,459 A1) and Shibuya et al., (US 6,291,898 B1) in error?
2. Was the Examiner's rejection of Claim 22 as unpatentable under 35 U, S. C. Sec. 103(a) over Aihara et al. in view of Hikmet, Gozdz et al. and Shiboya et al. in error?
3. Was the Examiner's rejection under 35 USC 103(a) of claims 5-7 and 24 as unpatentable over Aihara et al. in view of Hikmet, Gozdz et al. and Shibuya et al. as applied to Claims 2,4,9-10, 12-17, 21 and 23, and in further view of Yun et al. (US 7,279,251 B1) in error?
4. Was the Examiner's rejection of Claim 8 under 35 USC 103(a) as unpatentable over Aihara et al. in view of Hikmet, Gozdz et al. and Shibuya et al. as applied to Claims 2,4, 9-10, 12-17, 21 and 23 and in further view of Coustier et al. (US 2002/0110732 A1) in error?

ARGUMENTS

The Claims do not stand or fall together.

Claim 22 former claim 1 rewritten calls for a lithium based electrochemical device, which has first and second porous electrodes, which each electrode includes expanded metal microgrids with active materials including a binder coated thereon, at

least one porous ceramic separator between the electrodes, the separator containing particles of an electrically insulating material and a binder, with the separator having one side in bonding contact with the first electrode active material and an organic ion-conductive adhesive layer on the other side in contact with the second electrode and the separator, a non-aqueous electrolyte in contact with the separator and the electrodes and a moisture proof enclosure surrounding and containing the device, with exiting sealed terminals extending therefrom.

Claim 22 is not anticipated by or obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 2 dependent on claim 22 with all its limitations, calls for the electrodes to be an anode and a cathode.

Claim 2 is not anticipated by or obvious in view of the patents, or patent application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 4 dependent on Claim 22 with all its limitations, calls for the particles to be alpha alumna particles.

Claim 4 is not anticipated by or obvious in view of the patents, or patent application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 5 dependent on Claim 22 with all its limitations, calls for the particles to be inorganic lithium fluoride particles.

Claim 5 is not obvious in view of the patents, or patent application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 6 dependent Claim 22 with all its limitations, calls for the particles to be inorganic fluoride particles.

Claim 6 is not obvious in view of the patents, or patent application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 7 dependent on Claim 22 with all its limitations, calls for the particles to be a mixture of inorganic fluoride and alumina particles.

Claim 7 is not obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 8 dependent on Claim 22 with all its limitations, calls for the adhesive to be PVDF/HFP copolymer based and contain at least one aprotic liquid and at least one salt.

Claim 8 is not obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 9 dependent on Claim 22 with all its limitations calls for the adhesive to be PVDF Homopolymer based and contain at least one aprotic liquid and at least one salt.

Claim 9 is not obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 10 dependent on Claim 22 with all its limitations, calls for the electrolyte have a high boiling temperature and to be essentially non-flammable.

Claim 10 is not obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 12 dependent on Claim 22 with all its limitations, calls for the separator binder to be of a different polymer than the electrode polymers, and to use a different solvent.

Claim 12 is not obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 13 dependent on Claim 22 with all its limitations, calls for the device to be a bi-cell.

Claim 13 is not obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 14 dependent on Claim 22 with all its limitations, calls for the device to be a capacitor.

Claim 14 is not obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 15 dependent on Claim 22 with all its limitations, calls for the device to be a supercapacitor.

Claim 15 is not obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 16 dependent on Claim 22 with all its limitations, calls for the device to be a double layer capacitor.

Claim 16 is not obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 17 dependent on Claim 22 with all its limitations, calls for at least one of the electrodes to be smaller than the separator.

Claim 17 is not obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 20 dependent on Claim 22 with all its limitations, calls for the separator to be coated with is a mixture of dimethoxyethane in the range of 40% to 95% by percentage weight, polyvinylidene fluoride/hexafluoropropylene in the range of 5% to 20% by percentage weight, and a lithium based electrolyte in the range of 10% to 45% by percentage weight.

Claim 20 is not obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 21 dependent Claim 22 with all its limitations, calls for the separator to be coated with an adhesive which is a mixture of polyvinylidene fluoride in the range of 5% to 50% by percentage weight, and/or a lithium based electrolyte in the range of 50% to 95% by percentage weight.

Claim 21 is not obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 23 dependent on Claim 22 with all its limitations, calls for the separator to comprise a ceramic slurry, which is coated onto said first electrode active surface, and solidified and immobilized by solvent extraction. The slurry includes a mixture of methylpyrrolidinone in the range of 40% to 60% by percentage weight, polyvinylidene fluoride in the range of 2% to 10% by percentage weight, and alpha alumna in the range of 25% to 75% by percentage weight.

Claim 23 is not obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 24 dependent on Claim 22 with all its limitations, calls for the separator to comprise a ceramic slurry, which is coated onto said first electrode active surface, and

solidified and immobilized by solvent extraction. The slurry includes a mixture of H_20 in the range of 40% to 60% by percentage weight, polyvinyl alcohol in the range of 2% to 10% by percentage weight, and lithium fluoride in the range of 25% to 74% by percentage weight.

Claim 24 is not obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

1. Was the Examiner's rejection of Claims 2,4, 9-10, 12-17, 21 and 23 as unpatentable over Aihara (US 6,387,505 B1) in view of Hikmet (US 6,558,840 B1) Gozdz et al. (US 5,554,45 A1) and Shibuya et al., (US 6,291,898 B1) in error?

The Examiner's position is that:

CLAIM REJECTIONS-35 USC Sec. 103

11. Claims 2,4, 9-10, 12-17, 21, and 23 are rejected under 35 USC 103(a) as being unpatentable over Aihara et al. (US 6,558,840 B1), Gozdz et al. (US 5, 554,459 A), and Shibuya et al. (US 6,291,098 B1).

Regarding Claim 22, Aihara et al. teach a lithium based electrochemical device comprising two electrodes (col. 6, line 57-col. 7, line 18), which are porous (col. 4, lines 26-37), said electrodes including current collectors the active materials with binders coated thereon (col. 6, line 57 to col. 7, line 3), at least one separator between said electrodes (Aihara et al. claim 1), said

operator having one side in bonding contact with said first electrode active material (Aihara et al. claim 1), an organic ion-conductive adhesive layer on the other side of said separator in adherent contact with said separator and said other electrode (Aihara et al. Claim 1), a non-aqueous electrolyte in contact with said electrodes and said separator (Aihara et al. claim 1), and an enclosure surrounding and containing said device (col. 1, lines 39-45). However, Aihara et al. fail to specifically teach the current collectors comprise expanded metal microgrids, the separator is a porous ceramic separator, or the enclosure is a moisture-proof enclosure with exiting sealed terminals extending therefrom.

Hikmet teaches a porous ceramic separator (col. 1, lines 49-65) containing electrically insulating particles and a binder (col.3,, lines 45-55-62), for a lithium battery (col. 2, lines b61-62) wherein it is advantageous to use said ceramic separator because it is not susceptible to crack-formation and disintegration (col. 1, lines 44-47). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to create the lithium based electrochemical device of Aihara et al. wherein the device comprises the porous ceramic separator of Hikmet because said ceramic serarator is not susceptible to crack-formation and disintegration..

Gozdz et al. teach an electrically-conductive collector element

(current collector) for use in a lithium battery (abstract) wherein the current collector is a foil (12 or 16), preferably an expanded metal microgrid; (col. 3, lines 1-6), wherein it is advantageous to use said current collector because it maintains the integrity of a strong physical electrically-conductive bond (col. 1, lines 52-60). Therefore, it would have been obvious to one having ordinary skill In the art at the time the invention was made to create the lithium based electrochemical device of Aihara et al. wherein the device comprises the expanded metal microgrid of Gozdz et al. because said expanded metal microgrid the integrity of a strong physical electrically-conductive bond.

Shibuya et al. teaches a moisture proof enclosure (4) surrounding and containing a lithium electrochemical cell (see col. 7, lines 42-45) with exiting sealed terminals (5 and 6) extending therefrom (fig. 3), wherein it is advantageous to use said enclosure because of the superior air-tightness and mechanical strength (col. 1, lines 58-60). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to create the lithium based electrochemical device of Aihara et al. wherein the device comprises the enclosure of Shibuya et al. because enclosure has superior air-tightness and mechanical strength.

Regarding Claim 2, Aihara et al. teach said electrodes are an anode and a cathode (Aihara et al. claim 1).

Regarding Claim 4, Hikmet teach said particles are alumina particles (col. 2, lines 35-42).

Regarding Claim 9, Aihara et al. teach said adhesive is PVDF homopolymer (col. 6, lines 6-17) based and contains at least one aprotic liquid (N-methylpyrrolidone, col. 7, lines 54-59) and at least one salt (col. 5, lines 33-38). N-methylpyrrolidone is an aprotic organic solvent as evidence by Chen et al. (US Patent No. 5,741,609 A, col. 4, lines 25-33).

Regarding Claim 10, Hikmet teaches the electrolyte for a lithium battery comprising ethylene carbonate and diethyl carbonate in equal proportions (col. 4, line 2). It is Examiner's position that the electrolyte of Hikmet has a high boiling point and is essentially non-flammable.

Regarding Claim 12, Aihara et al. teach the separator binder is of a different polymer than electrodes' binders (col. 7, lines 1-5, electrode binder is PVDF, separator binder is PP/PE/PP).

Regarding Claims 13-16, in view that the combined teaching provides for the claimed elements it is reasoned that the elements are capable of acting as a bi-cell, capacitor, supercapacitor, or double layer capacitor.

Regarding Claim 17, Aihara et al. teach that at least one electrode is smaller than said separator (col. 7, liners 11-14).

Regarding Claim 21, Aihara et al. teach that said separator is

Coated with an adhesive that is a mixture of polyvinylidene fluoride in a range of 5-10 wt.% (col. 7, lines 54-59 and col. 8, lines 27-32).

Regarding Claim 23, Aihara et al. in view of Hikmet, Gozdz Et al. and Shibuya et al. teach the electrochemical device as stated above. It is noted that Claim 23 is a product-by-process claim. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. *In re Thorpe,* 777 F.2d 695,698, 227 USPQ 964 (Fed. Cir. 1985). The battery taught by et al. in view of Hikmet, Gozdz et al. and Shibuya et al. is obvious to that of Applicant's, and therefore, Applicant's process is not given patentable weight in this claim."

The Appellants position is that : The US Patent to Aihara et al. (No. US 6,387,565 B1) is directed to a battery which does not have an outer case, with electrodes joined by a separator and an adhesive resin layer. In other words the Aihara et al. patent uses a microporous separator glued to both electrodes, with two layers of glue, one on each side of the separator, which adhesive is porous with a ceramic filler. Aihara et al. does not teach a porous ceramic separator, or the use of expanded metal microgrids as current collectors, and such is admitted to by the Examiner.The US patent to Hikmet No. US 6,558,840 B1, defines an electrode for use in an non-aqueous battery. Hikmet uses UHMW PE as a binder not the PVDF of appellants, and welds the cell under heat and pressure, not by solvent adhesive, which is very different than Appellants.

This structure is not useful in Appellants devices as it swells as a separator, and is not glued to the cathode. The US patent to Gozdz et al. No. 5,554,459 is directed to an electrically conductive collector element, which may be in the form of an expanded microgrid. There are no other features of Appellants devices in Gozdz et al. The US patent to Shibuya et al. No. US 6,291,098 B1, describes a thin type cell having superior air-tightness and mechanical strength. There is no suggestion of any of the other features of Appellants device in Shibuya et al. .The Examiner is incorrect in that DEC is flammable and not non-flammable as stated by him. It should also be noted that none of the patents remotely suggest the combinations proposed by the Examiner.

2. Was tthe Examiner's rejection of Claim 22 as unpatentable under 35 U. S. C. Sec 103(a) over Aihara et al. in view of Hikmet, Gozdz et al. and Shibuya et al. in error?

The Examiner's position is that:

> "Regarding Claim 22, Aihara et al. teach a lithium based electrochemical device comprising two electrodes (col. 6, line 57 – col. 7, line 18), which are porous (col. 4, lines 26-37), said electrodes including current collectors the active materials with binders coated thereon (col. 6, line 57 to col. 7, line 3), at least one separator between said electrodes (Aihara et al. claim 1), said separator having one side in bonding contact with said first electrode active material (Aihara et al. claim 1), an organic ion-conductive

adhesive layer on the other side of said separator in adherent contact with said separator and said other electrode electrode (Aihara et al. claim 1), a non-aqueous electrolyte in contact with said electrodes and said separator (Aihara et al. claim 1), and an enclosure surrounding and containing said device (col. 1, lines 39-45). However, Aihara et al. fail to specifically teach the current collectors comprise expanded metal microgrids, the separator is a porous ceramic separator, or the enclosure is a moisture-proof enclosure with exiting sealed terminals extending therefrom.

Hikmet teaches a porous ceramic separator (col. 1, lines 49-65) containing electrically insulating particles and a binder (col. 3, lines 45-55) for a lithium battery (col. 2, lines 61-62), wherein it is advantageous to use said ceramic separator because it is not susceptible to crack-formation and disintegration (col. 1, lines 44-47). Therefore, it would have been obvious to one having ordinary skill In the art at the time the invention was made to create the lithium based electrochemical device of Aihara et al. wherein the device comprises the porous ceramic separator of Hikmet because said ceramic separator is not susceptible to crack-formation and disintegration.

Gozdz et al. teach an electrically-conductive collector element (current collector) for use in a lithium battery (abstract) wherein the

current collector is a foil (12 or 16), preferably an expanded metal microgrid (col. 3, lines 1-6), wherein it is advantageous to use said current collector because it maintains the integrity of a strong physical electrically-conductive bond (col. 1, lines 52-60). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to create the lithium based electro-chemical device of Aihara et al. wherein the device comprises the expanded metal microgrid of Gozdz et al. because said expanded metal microgrid the integrity of a strong physical electrically-conductive bond.

Shibuya et al. teaches a moisture proof enclosure (4) surrounding and containing a lithium electrochemical cell (see col. 7, lines 42-45) with exiting sealed terminals (5 and 6) extending therefrom (fig. 3), wherein it is advantageous to use said enclosure because of the superior air-tightness and mechanical strength (col. 1 lines 58-60), Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to create the lithium based electrochemical device of Aihara et al. wherein the device comprises the enclosure of Shibuya et al. because enclosure has superior air-tightness and mechanical strength"."

The Appellants position is that: The US Patents to Aihara et al.,Hikmet, Gozdz et al. and Shibuya et al;. cited by the Examiner have all been discussed above, and do not remotely suggest the combinations proposed by the Examiner.

3. Was the Examiner's rejection under 35 USC 103(a) of Claim 5-7 and 24 as unpatentable over Aihara et al. in view of Hikmet, Gozdz et al. and Shibuya et al. as applied to Claims 2,4, 9-10, 12-17, 21 and 23, and in further view of Yun et al. (US 7,279,251 in error?

The Examiner's position is that:

> "12. Claims 5-7 and 24 are rejected under 35 USC 103(a) as being unpatentable over Aihara et al. in view of Hikmet, Gozdz et al., and Shibuya et al. as applied to Claims 2, 4, 9-10, 12-17, 21 and 23 above, and in further view of Yun et al. (US 7,279,251 B1).
>
> Aihara et al. in view of Hikmet, Gozdz et al., and Shibuya et al. teach a lihtium-based electrochemical device as recited as in paragraph 11 above. However, Aihara et al. in view of Hikmet, Gozdz et al. and Shibuya et al. fail to teach a separator containing fluoride particles.
>
> Regarding Claim 5, Yun et al. teach a secondary battery with a separator comprising inorganic lithium fluoride-particles (col. 4, lines 20-25). Yun et al. teach it is advantageous to add a filing agent to a separator because of improved porosity and mechanical strength (col. 4, lines 18-20). Yun et al. further teach the functional equivalency of the addition of either LiF or Al_2O_3 to the separator (col. 4, lines 18-25). Therefore, it would have been obvious to one of ordinary skill in the

art at the time the invention was made to create the electrochemical device of Aihara et al. in view of Hikmet, Gozdz et al., and Shibuya et al. with a porous ceramic separator comprising inorganic lithium fluoride particles because Yun et al. teach resultant improved porosity and mechanical strength of the separator.

Regarding Claim 6, Yun et al. teach a separator comprising inorganic fluoride particles (col. 4, lines 20-25)..

Regarding Claim 7, Yun et al. teach a separator comprising inorganic fluoride and alumina particles (col. 4, lines 20-25).

Regarding Claim 24 Aihera et al. in view of Hikmet, Gozdz Et al. and Shibuys et al. teach the electrochemical device as stated above. It is noted that Claim 23 is a product-by-process,claim. Even though product -process claims are limited by and defined by the process, determination of patentability is based on the product itself. *In re Thorpe*, 777 F.2d 695,698,227 USPQ 964, 966 (Fed. Cir. 1985). The battery taught by Aihara et al. in view of Hikmet, Gozdz et al., and Shibuya et al. in view of Yun et al. is obvious to that to Applicant's, and therefore, applicant's process is not given patentable weight in this claim."

The Appellants position is that:: The US patents to Aihara et al. , Hikmet, Gozdz et al. , and Shibuya et al. are discussed above, and apply hereto as before. The US Patent to Yun et al. No. US 7,279,251 B1, is directed to a lithium secondary battery comprising a super fine fibrous polymer separator film and its fabrication method. The chemistry is

different from that of applicant's, and Yun does not disclose applicant's porous ceramic separator wit a layer of organic ion-conductive adhesive, nor does it disclose the other structure of applicants'. There is no suggestion in Yun et al. , that it can be combined with the other patents as suggested by the Examiner.

4. Was the Examiner's rejection of Claim 8 under 35 USC 103(a) as unpatentable over Aihara et al. in view of Hikmet, Gozdz et al. and Shibuya et al. as applied to Claims 2, 4, 9-10, 12-17, 21, and 23 above, and in further view of Coustier et al. (US 2002/0110732 A1) in error?

The Examiners position is that:

> "13. Claim 8 is rejected under 35 USC 103(a) as being unpatenable over Aihara et al. in view of Hikmet, Gozdz et al., and Shibuya et al. as applied to Claims 2, 4, 9-10, 12-17, 21 and 23 above, and in further view of Coustier et al. (US 2002/0110732 A1).
>
> Aihara et al. in view of Hikmet, Gozdz et al. and Shibuya et al. teach an electrochemical device as recited in paragraph 11 above However, Aihara et al. and Arrance et al. fail to teach said adhesive is a PVDF/HFP copolymer.
>
> Coustier et al. teach an electrochemical cell having a Binder (adhesive, 105) to enhance the bonding of the electro-chemical cell's components cell's components to each other (par. 23), for us as said binder (adhesive) Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to create the electrochemical device as taught by Aihara et al. in

view of Hikmet, Gozda et al. and Shibuya et al. wherein the PVDF/HFP is substituterd for PVDF as a base for the adhesive because Coustier et al. teach the functional equivalency of PVDF and PVDF/HFP copolymer for use as an adhesive material in an electrochemical cell."

The US Patents to Aihara et al., Hikmet, Gozdz et al., and Shibuya et al., are discussed above. The application publication to Coustier et al. No. (US2002/0110732 A1) is directed to a electrochemical cell having a binder, but there is no suggestion in Coustier et al. of the combinations suggested by the Examiner.

In order to establish a prima facie case of obviousness, the prior art teachings must be sufficient to suggest the making of the claimed construction. Here there is no teaching or suggestion in the prior art of record and relied upon by the Examiner, which would have motivated one of ordinary skill in the art, at the time the invention was made, to make the modifications to the prior art in the manner the Examiner proposes to obtain appellant" electrochemical devices.

One of the more difficult aspects of resolving questions of non-obviousness is the necessity "to guard against slipping into the use of hindsight." In re Carroll, 601 F.2d 1184, 1186, 202 USPQ 571, 572(CCPA 1979) (quoting Graham v. John Deere Co., 383 US 136 (148 USPQ 459, 474)(1965)). The Patent and Trademark Office has the burden of showing that the prior art would have taught or suggested the claimed invention to one of ordinary skill in the pertinent art, In re Clinton, 527 F2d 1226, 1228, 188 USPQ 365, 367 (CCPA 1976).

In re Shaffer, 108 USPQ 326, 229 F.2d 476 (CCPA 1956) is one of many cases in which it is pointed out that for a combination of old elements to be patentable, the

elements must cooperate in such a manner as to produce a new, unobvious, and unexpected result, citing In re Kaufman, 39 CCPA (Patents) 769, 193 F.2d 331, 92 USPQ [4] and In re Lindberg, 39 CCPA (Patents) 866, 194 F.2d 732, 93 USPQ 23.

> "Furthermore, as a general matter, in determining the concept of a new and useful improvement, must be considered along with the actual means of achieving the improvement. In re Delancy, 34 CCPA (Patents) 849, 159 F.2d 737, 72 USPQ 477. In re Bisley, 39 CCPA (Patents) 982, 197 F.2d 355, 94 USPQ 80."

There must have been a reason apparent at the time the invention was made to the person of ordinary skill in the art for applying the teaching at hand, in the manner proposed or the use of the teaching as evidence of obviousness will entail prohibited hindsight. In re Nomiya, 509 F.2d 566, 184 USPQ 607, 613 (CCPA 1975).

The CAFC in a well-known case set forth the proper inquiry for evaluating references as: References must be considered for all that they teach. W.L. Gore & Assoc. v. Garlock, Inc. 721 F.2d 1540, 1550, 220 USPQ 303, 311 (Fed. Cir. 1983) cert. Denied, 469 US 851 (1984).

See also In re Fritch, 23 USPQ 2d 1780 (CACF 1992(.

"In proceedings before the Patent and Trademark Office, the Examiner bears the burden of establishing a prima facie case of obviousness based upon the prior art." In re Piasecki, 745 F.2d 1468, 1471-72, 223 USPQ 785, 787-88 (Fed. Cir. 1984).

The Examiner has not satisfied this burden as he has not shown any objective teachings in the prior art, specifically Aihara et al. Hikmet, Gozdz ety al., and Shibuya et

al., which would lead one of ordinary skill in the art to make the described electrochemical devices. The Examiner has not shown that knowledge generally available to one of ordinary skill in the art would have lead that individual to obtain the electrochemical devices.

Accordingly, the Examiner has failed to meet the burden of establishing obviousness, and should be reversed

CONCLUSION

The Examiner has not made a prima facie case because the electrochemical devices of appellants are not called for or suggested in the prior art patents or application publications to Aihara et al., Hikmet., Goizdz et al., Shiobuya et al. Coustier et al., ona Yun et al. Moreover, any prima facie case has been rebutted by the showings made here.

It is believed that the claims define a new, useful, and unobvious invention. Reversal of the Examiner's rejection and allowance of the claims 2, 4 9-10, 12-17, and 20-24 inclusive is respectfully requested.

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CLAIMS APPENDIX

Claim 2.

An electrochemical device as defined in claim 22, in which said electrodes are an anode and a cathode.

Claim 4.

An electrochemical device a s defined in claim 22, in which said particles are alpha alumina particles.

Claim 5.

An electrochemical chemical device as defined in claim 22, in which said particles are inorganic lithium fluoride particles.

Claim 6.

An electrochemical device as defined in claim 22, in which said particles are inorganic fluoride particles.

Claim 7.

An electrochemical device as defined in claim 22, in which said particles are a mixture of inorganic fluoride and alumina particles.

Claim 8.

An electrochemical device as defined in claim 22, in which said adhesive is PVDF/HFP copolymer based and contains at least one aprotic liquid and at least one salt.

Claim 9.

An electrochemical device as defined in claim 22, in

which said adhesive is PVDF homopolymer based and contains at least one aprotic liquid and at least one salt.

Claim 10.

An electrochemical device as defined in claim 22, in which said electrolyte has a high boiling temperature and is essentially non-flammable.

Claim 12.

An electrochemical device as defined in claim 22, in which said separator binder is of a different polymer than said electrodes' electrode binders, and uses a different solvent.

Claim 13.

An electrochemical device as defined in claim 22, in which said cell is a bi-cell.

Claim 14.

An electrochemical device as defined in claim 22, in which said device is a capacitor.

Claim 15.

An electrochemical device as defined in claim 22, in which said device is a supercapacitor.

Claim 16.

An electrochemical device as defined ion claim 22, in which said device is a double layer capacitor.

CLAIMS APPENDIX

Claim 17.

An electrochemical device as defined in claim 22, in which said at least olectrode of said electrodes is smaller than said separator.

Claim 20.

An electrochemical device as defined in claim 22, in which said separator is coated with an adhesive which is a mixture of dimethoxyethane in the range of 40% to 95% by percentage weight, polyvinylidene fluoride/hexafluoride-propylene in the range of 5% to 20% by percentage weight, and a lithium based electrolyte in the range of 10% to 45% by percentage weight.

Claim 21.

An electrochemical device as defined in claim 22, in which said separator is coated with an adhesive which is a mixture of polyvinylidene fluoride in the range of 5% to 50% by percentage weight, and/or a lithium based electrolyte in the range of 50% to 95% by percentage weight.

CLAIMS APPENDIX

Claim 22.

A lithium based electrochemical device comprising at least

a first and a second porous electrode,

said electrodes each include expanded metal microgrids

with active materials including a binder coated thereon,

at least one porous ceramic separator between said

electrodes,

said separator containing particles of an electrically

insulating material and a binder,

said separator having one side in bonding contact with

said first electrode active material,

an organic ion-conductive adhesive layer on the other side

of said separator in adherent contact with said separator

and said second electrode,

a non-aqueous electrolyte in contact with said electrodes,

and said separator, and

a moisture proof enclosure surrounding and containing

said device, with exiting sealed terminals extending therefrom.

Claim 23.

An electrochemical device as defined in claim 22, in which

said separator comprises a ceramic slurry, which is coated

onto said first electrode active surface, and solidified

and immobilized byu solvent extraction,

said slurry including a mixture of methylpyrrolidinone in the range of 40% to 60% by percentage weight, polyvinylidene fluoride in the range of 2% to 10% by percentage weight, and alpha alumina in the range of 25% to 75% by percentage weight.

Claim 24.

An electrochemical device as defined in claim 22, in which said separator comprises a ceramic slurry, which is coated onto said first electrode active surface, and solidified and immobilized by solvent extraction,

said slurry including a mixture of H2O in the range of 40% to 60% by percentage weight, polyvinyl alcohol in the range of 2% to 10% by percentage weight, and lithium fluoride in the range of 25% to 74% by percentage weight.

EVIDENCE APPENDIX

NONE

RELATED PROCEEDINGS APPENDIX

NONE